Bangalore Metropolitan Transport Corporation

Shanthinagar, Bengaluru-570027.

Request for Proposal Selection of Service Provider for Procurement, Operation and Maintenance of 120 Nos. 900mm floor height City type 9 mtr Non AC Electric Buses on Gross Cost Contract (GCC) Model under National Clean Air Programme (NCAP) and State Urban Transport Fund (SUTF) of Directorate of Urban Land Transport (DULT).

VOLUME - II

SPECIFICATIONS

Bangalore Metropolitan Transport Corporation

Technical specifications of Electric bus Compliant with the requirements of CMVR AIS:052 (Type – I) + AIS:153 + UBS II +& AIS:140 of 9m Non AC electric bus

SL No.	Description	Technical Specification
	Statutory requirements	The e-Bus shall be designed and manufactured in accordance with the specifications & AIS-052 and UBS-II: Code of Practice for Bus Body Design & Approval [Bus Code], AIS – 049, AIS – 038 and AIS-153 all amended up to date as also those related to easy passenger accessibility including for persons with disabilities (PWDs).
1	Propulsion system	Electrically propelled Bus using electric propulsion System
2	Type of Battery	Li-ion or Li-ion Phosphate Battery or Li NMC or superior.
3	a. Battery Pack Rating and Energy/Power b. Minimum & Maximum Charging% c. Motor/s Capacity d. Charging standard	I. No. of Motors / Batteries as per Manufacturer's design. II. Power consumption –1.0 kwh per kilometer III. Electrical Re-generation required. IV. Charging Mode –as per manufacturers design. V. Off-Board or On-Board Charging Required VI. Charging Time - 2 hours- overnight charging. VII. Safety–Short circuit/ Over Temperature / Lightening Protection as per CMVR. VIII. CCS 2.0 IX. The battery shall have capacity to operate 120 kms in single charge at 80% SOC and opportunity charging of 45 minutes with assured kms of 180kms per day
3.1	Battery Cooling System	Liquid Cooling system or As per manufacturer design
3.2	Battery Life	As per manufacturer design
3.3	Battery Charging System	DC fast charging by CCS 2.0 or As per manufacturer design

3.4	Electric Drive Motors	Optimal Rating, Type, Make, Model of Electric Drive Motors with minimum maintenance as per manufacturer design
3.5	Electric propulsion system motor rating / power sufficient to provide Rated Performance at GVW in Stop/ Start In Urban Operation:	
a.	Acceleration (Meter / Sec.^{2})	≥0.8 or as per manufacturer design
b.	Bus Speed of 0 – 30 kmph in Seconds.	≤10.5 seconds or as per manufacturer design
c.	Maximum Speed	Maximum speed without speed limiter to be minimum 70 +/- 5 kmph or as per manufacturer design
d.	Grade ability from Stop at GVW	17% or as per manufacturer design
e.	Rated HP/torque preferably at lower rpm range	Rated HP at low rpm and Maximum torque required at lower range of motor RPM and spread over a wider range of RPM Sufficient torque to meet the acceleration, gradeability, and range requirement or as per manufacturer design
f.	Power requirement for ITS system	Required to be provided by traction battery of electric propulsion system or as per manufacturer design
3.6	Noise norms	As per CMVR & bus code
3.7	Electric propulsion system & its requirements.	Electrical Propulsion System / Sub Systems(Batteries) Temperature, Motor Speed in RPM, Vehicle Speed, Motor Percent Load (Torque) as per AIS 038 / AIS 049, Diagnostic Message (Electrical Propulsion System Batteries, Cooling System, Motor, Traction Controller Specific), SOC with Vehicle Health Monitoring System (Battery Health + Regenerative Brake Charging). Electric propulsion system should be able to operate efficiently at ambient temperatures / environmental conditions of urban areas.
3.8	Electrical Propulsion System Location	As per Manufacturer's Design / Preferably Battery Location below floor.
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary

5.	Bus Characteristics	
5.1	Front Axle	As per manufacturers design UBS-II / AIS 052/CMVR
5.2	Rear Axle	As per manufacturers design UBS-II / AIS 052/CMVR
6	Suspension (Front & Rear)	Air suspension or as per manufacturer design
6.1	Anti-roll bars/stabilizers	Required at front and rear or as per manufacturer design
6.2	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear
6.3	Controls (optional)	Electronically controlled air suspension system or as per manufacturer design
7	Steering	As per manufacturers design UBS-II / AIS 052/CMVR
8	Brakes	As per manufacturers design UBS-II / AIS 052/CMVR
8.1	Braking system	Mandatory ABS with Disc at front and Drum at rear OR disc brake at front and rear or as per manufacturer design
9	Electrical system for auxiliary devices	24V DC
9.1	Batteries (ancillaries equipment and light and light signalling devices)	Low maintenance type leads acid batteries for 24 V & Min 100Ah system- performances as per BIS: 14257- 1995 (latest).
9.2	Electrical wiring & controls -type	Multiplexing type -- As specified separately under ITS specifications and Conforming to IP 67. It should be as per UBS-II and AIS 153.
10	Speed limiting device (optional)	Mandatory as per CMVR
11	Tyres	Size and performance as per CMVR.
12	Charging range	The battery shall have capacity to operate 120kms in single charge at 80% SOC and opportunity charging of 45 minutes with assured kms of 180km per day
13	Type of Bus	9-meter Standard floor (900mm) Non AC Bus Model should be in compliance with CMVR & Bus Code and approved as per AIS: 052 by any Indian Government testing agency like ARAI, ICAT, NATRaX, CIRT etc.
13.1	Bus characteristics	9- Meter (Midi)
A	Overall length (excluding bumper)	8400-9500 mm
B	Overall width (sole	As per CMVR

	bar/floor level- extreme points)	
C	Overall height (unladen - at extreme point)	As per CMVR
D	Floor Height above ground	Standard Floor- 900 mm
E	Chassis	As per CMVR Rules Wheel base: CMVR Front Over Hang: As per CMVR Rear Over Hang: As per CMVR Total length: As per CMVR
13.2	Maximum turning circle radius (mm)	As per CMVR
13.3	Clearances (mm)	
A	Minimum Axle clearance (mm)	Minimum 165 mm or As per Manufacturer design
B	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body &> 170 mm for the parts moving vertically with axle or As per Manufacturer design
C	Minimum ground clearance (un-kneeled) atGVW	Within the wheelbase not less than 240mm or As per Manufacturer design
13.4	Angles (degrees)	
A	Angle of approach (unladen)	Not less than 8.5° for Standard bus & 8.0° for Midi bus or As per Manufacturer design
B	Angle of departure (unladen)	Not less than 9° for Standard bus & 8.5° for Midi bus or As per Manufacturer design
c	Ramp over angle (half of break-over angle)	Not less than 4.8° or As per Manufacturer design
14	Bus Gates/Doors (Passenger Doors, Driver door & Emergency Exit & Door) Ramp for wheel chair at the gates	As per Manufacturers design/CMVR/UBS-II/AIS-052/homologation certificate is to be obtained or As per Manufacturer design
a.	Service Doors	One service door at front door before the front axle as per AIS 052 and one service door at center between the axle of 1200 mm wide clear aperture shall be fitted at middle nearside of the bus as per provisions of the AIS 052(Bus Code) for Type I, category. Door aperture without flaps shall be 1200 mm min., fully opened clear door width shall be 1050

		mm ± 50 mm with door height of 1900 mm min. Both the entrance and the exit doors shall be of inside swing type or double jack knife type. Service doors shall be provided with grab handles. An appropriate number of alighting buzzers should be provided in position that are easily accessible for seated or standing passengers. The push button of an alighting buzzers should be clearly visible: of adequate size, installed at 900 mm to 1200 mm from the bus floor level and display the information in Braille/raised numbers as well.
15	Bus design	
15.1	Design type approval	As per CMVR, AIS;052 + AIS:153 IS 16833 and IS 16490
15.2	Bus structure - materials specifications etc.	OEM should ensure GI tubular structure to meet the requirements of Annexure 3 of UBS II + AIS;052 + AIS:153 Exterior panels: as per OEM design
15.3	Insulation	FR grade material as per IS 15061 or As per Manufacturer design
A	Roof and side	FR Grade material glass wool, PU foam or thermocol: As per AIS:052.
B	Battery Pack compartment	
15.4	Floor type/Materials etc.	
A	Type of Floor	As per AIS:052 requirements.
B	Steps on floor	As per AIS:052 requirements.
C	Maximum floor slope	As per Bus AIS:052
D	Floor surface material	Minimum 12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 0.95 - 1.25 gms/cc conforming to IS 3513 (Part- 3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000 (IS15061:2002). The chequered plywood 12 mm thick is also allowed as per the relevant

		standard for the quality and fire resistance/ flammability. or As per Manufacturer design
E	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS:15061:2002 for FR grade. or As per Manufacturer design
15.5	Safety glasses and fittings:	
A	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, lateral/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed or As per Manufacturer design
B	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass- plain/flat/curved at centre& curved at cornersIS:2553 (Part-2)–1992/latest or As per Manufacturer design
C	Side windows:	Top fixed and bottom sliding toughened glass IS 2553 (Part-2)-1992/latest or As per Manufacturer design
D	Glass specifications	Toughened glass IS2553 (Part-2)-1992/latest
	Glass thickness:	4.8-5.3mm
E	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS:15061:2002 for FR grade. or As per Manufacturer design
E	Window & other glasses - material specs, thickness etc.	Toughened as per IS:2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
F	Safety glass	As per CMVR
G	Rear view mirrors	As per CMVR
15.6	Seating and gangway etc.	Type Approved Seats & seating layout for 2x2 as per bus code ‘PP-LD’ (Polypropylene Low Density)/ LDPE moulded construction, with moulded flame retardant Polyurethane (PU) cushion for seat & back rest meeting the performance requirements of AIS 023 and other requirements as per the AIS-052. The gangway shall be as per the provisions of the AIS 052 Bus Code/UBS-II and would meet the requirements of AIS-153.
A	Minimum seating	33 numbers for Midi (9- meter) bus

	capacity	excluding driver
15.7	Corrosion prevention & painting	As per AIS 052
15.8	Towing Hook	As per manufacturers design UBS-II / AIS 052/CMVR
15.9	GVW	As per CMVR Rules & its amendments from time to time.
16	Electrical system	As per CMVR and as per AIS 153, Copper conductors with fire retardant as per IS/ISO:6722:2006 as per appropriate class. Conductor
16.1	Electrical cables:	
16.2	Conductor cross section	cross- section varying as per circuit requirements, minimum cross- section 0.5 sq. mm. Quality marking may also be as per equivalent or better European, Japanese, US standards, Conforming to IP 67 water& air tight for traction battery. For Bus Body Building Multiplex wiring /ISO 6722
16.3	Safety requirements of electrical	
A	Fuse	As per AIS 052
B	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	
C	Location of cables away from heat sources	
D	Type approval of circuit diagram as per standards related to electric equipment's/wiring	
E	Battery cut - off switch (isolator switch):	
16.4	Wind screen wiper:	
A	Wiper motor:	As per CMVR: IS 15802
B	Wiper arm/blade:	
16.5	Driver cabin fan	Required. As per CMVR
16.6	Lighting - internal & external and illumination	As per AIS 052 and AIS 153
16.7	Illumination requirements/performance of:	
A	Dash board tell-tale lighting/control lighting	As per AIS 052
B	Cabin lighting - luminous flux of all	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux

	lamps for cabin Lighting	
C	Passenger area lighting - luminous flux of all lamps for Passenger area lighting	As per AIS 052
17	Safety related items:	
17.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS 005 & 015
17.2	Passengers seat belt:	As per AIS 052
	Number/location	
17.3	Driver/Passenger/ wheelchair seat belt anchorage	
17.4	Fire extinguisher:	As per AIS 052
17.5	Handrails minimum length*diameter*height above floor in mm	Colour contrasting and slip resistant sleeves with MS tubing of 32 mm dia, 3 mm thick/ powder coated Rest as per AIS 052 or As per Manufacturer design
17.6	Handholds:	Colour contrasting and slip resistant/powder coated. 2 to 4numbers. Handholds per bay. Rest as per AIS 052 or As per manufacturer design
17.7	Stanchions:	*As Manufacturer design/CMVR/AIS-052/UBS-II*
17.8	Passengers stop request signal	High visibility bell pushes/pulley chord/touch tape shall be fitted at a height of 1.2 meter on alternate stanchions mainly for persons with disabilities.
17.9	Window guardrails:	As per AIS 052 (for Non-AC buses)
17.10	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.
17.11	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR
17.12	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008
17.13	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature
17.14	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30o of the longitudinal axis of the bus. As per CMVR & IS 9760- Ring/ pin Type
17.1	Warning triangle	As per AIS 052/CMVR

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17.16	Fog lighting	As per AIS 052/CMVR
17.17	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system. FRP As per CMVR and AIS 052 or As per Manufacturer design
	Impact strength for bumpers	As per AIS 052
17.18	Passenger safety system	Mandatory allowing bus motion on doors closing and doors opening only when the bus is stopped
18	Windows	
A	Type of window	Sliding type windowpanes for Non-AC bus.
B	Minimum height of window aperture (clear vision)* in mm	As per UBS II
C	Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm	As per AIS 052
D	Minimum height of upper edge of window aperture from bus floor	As per AIS 052
E	Minimum width of windows (clear vision zone)	As per AIS 052
19	Life cycle requirements of bus (whichever is earlier)	As per Manufacturer design
20	Maximum noise levels inside the saloon -test procedure as per AIS 020	As per requirement of AIS:153
21	Energy Consumption of eBus	Midi Bus (9 m) Non AC: 1.0 kWh/km
22		Alphanumeric Dual Display Technology

	Destination boards	Amber colour LED based electronic route display system in English and appropriate regional language of High Intensity illumination with automatic brightness control shall be installed at the front, rear and side of bus with GPS feed triggered display on internal display board and announcement of name of approaching bus-stop (voice announcement system) inside the bus. Destination boards should comply with IS 16490 BIS standards. Information on a route and its final destination should be displayed outside the bus in large text, especially on the front and side of the bus. This information should be in bright contrasting color and be well illuminated by an external light to make it readable in the dark.
23	Surveillance Cameras	Four cameras, three in the passenger's saloon and one for rear view (reverse camera).
24	Roof hatches	As per bus code
25	Paint	Colour scheme as per Authority requirement. The approval of design and shade of the paint be obtained from authority before painting. All the structural members of the bus shall be treated for corrosion prevention internally as well as externally and painted wherever required. The Polyurethane (PU) painting conforming to BIS: 13213-1991 or latest shall be used for exteriors painting of the bus including interiors wherever required. Colour shade shall match to the shades as per BIS: 5-1978 or latest. In case of Matt black paint, the same shall be tested as per IS: 13213-1991 or latest except the gloss value should be up to 30 units.
	Colour Scheme	Exterior, interior colour schemes and logo/ graphics to be applied will be as notified by Public Transport Authority. The buses must be recognizable as environmentally friendly battery buses.

26	Jack	As per CMVR & bus code
27	Fire Extinguisher	As per CMVR & bus code
28	Fire Detection & alarm System (FDAS)	As per CMVR & bus code
29	Tool Kit	As per CMVR & bus code
30	First Aid Box	As per CMVR & bus code
31	Driver Work Area	Driver Work Area should be as per AIS : 047 & Fan to be provided.
32	Dash Board	As per Manufacturers design UBSII/AIS-052/CMVR
33	Provision for Disabled Person.	All Provision for Disabled Person to be provided except wheelchair
34	Head Light Assy., Fog Lamp, Side Indicator Lamp, Tail Lamp Assy .Etc..	As per CMVR Rules/AIS -052 requirement
35	Passenger saloon Light	Sufficient and attractive LED Tube Lights to meet the requirement of LUX as per AIS: 052.
36	Number plate Light	For Rear side number plate light should be provided.
38	ETM Charger	Provision for ETM Charger to be provided
39	PA System	Amplifier, 4 Nos. Speaker of reputed make
40	Warning Device for Emergency door	Not applicable
41	Hooter	As per AIS-052,/ UBS-II/CMVR be provided.
42	Emergency/Panic Buttons	To carry out the online vehicle tracking there shall be a tracking device (VLT/ATD) as per the system conforming to provision stipulated in IS 16833:2018 – Annex A with the latest Amendments (with compliance of AIS 140 with emergency buttons for access to every passenger in the bus, preferably input box).
43	Side Indicator Lamp	2 nos of side indicator category 6 lamps at LH and RH (Type Approved)
44	Side Marker Lamp	Type Approved with Umber Reflector as per AIS:052 requirements.
45	End Outline Marker(Height marker)	2 Nos. White at Front & 2 Nos. of Red at Rear with Proper Fitment. (Type Approved).
46	Reverse Horn	1No. to be provided.

48	Stickers & Branding	Graphics for Electric, Monogram, brand etc., be done by using good quality reflecting stickers as per choice and design of BMTC. One set of blue signage stickers be provided in the saloon portion mentioning seats for ladies, physically challenged ladies, physically challenged men, senior citizen, emergency door, no smoking and red colour cross mark for door glass. Radium stickers with BMTC monogram be provided on either side of the vehicle and on the rear side as BMTC in kannada, BMTC sign be provided on front grill, all the letterings shall be in kannada, type, size and colour and location as per BMTC requirements. One chart showing the chassis details be screen printed below waist rail by the side of front door.
49	**Automatic Tracking Device and Emergency Button Specifications** The Automatic Tracking Device (ATD) and Emergency Buttons should be fully compliant to AIS 140standard (as amended from time to time) and should be type approved from testing agencies authorized under CMVR. In addition to above, the ATD should meet the following requirements: i. The ATD shall provide the output as per NMEA0183 for GPRMC packets to PIS controller through RS232 at minimum frequency of 1 Hz. ii. ATD should support Over the Air (OTA) firmware and configurationally parameter updation. iii. ATD should send device health monitoring parameters. iv. ATD should send location data @ 10 seconds during bus ignition on and @1 minutes when bus ignition off. v. ATD should have inbuilt battery with a backup of at-least one hour vi. ATD should come with normal SIM slot with plastic sim (minimum 4G). The data communication from the ATD with all incidents should be sent to BMTC ITS /AVLS application through API by maintaining the server provided by the service provider. On pressing of any of emergency button the emergency alert should be sent to the configured IP address. In the absence of GPRS	

	network, the alert should be sent as SMS.
50	**In- bus Camera Specifications**

No.	Parameter	Minimum Specifications
1	No of cameras	4 (2 cameras in saloon area, 1 camera in driver and 1 reverse camera)
2	Power Supply	PoE through mNVR .should be automatically switched on with engine and power down on ignition off.
3	Camera feed display	Relay feed to control center on demand. Web viewer, cloud enabled CMS & DMSS
4	Fixed lens	3.6 mm
5	Picture Resolution	752 H x 582 V (PAL)
6	Resolution	25/30fps@1080P
7	Picture Sensor	1/3” 2Megapixel progressive scan CMOS,
8	IR distance	Min 20 m
9	Image Enhancement	DWDR, Day/Night(ICR), 3DNR,AWB,AGC,BLC
10	Video and Audio Compression	The IP camera shall support H.264/ 265 video compression and G.711 or G.726 audio compression
11	Protection	Minimum IP 66
12	IP Camera	Yes
13	Temperature	-10 deg C to + 60 deg C
14	Humidity	5% to 95 %
15	Vibrations	10g
16	Motion detection	Automatic
17	Camera Ruggedness	Rugged, vibration, shock and tamper proof Metal housing, Aviation Connectors Installation :Anti Vibration with Adjust Angle; Ø Horizontal: 0~355 degree with

No.	Parameter	Minimum Specifications
		3-point locking Ø Vertical:0~90 degree with 2-point locking
18	Test Compliances	As stated later in the document

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MNVR Specifications

Parameter	Minimum Technical Specifications
Video Format	752 H x 582 V (PAL)
Number of Video Inputs	4 channels
Number of Video Outputs	1 suitable
Number of Audio Inputs	4channels
Number of Audio Outputs	1
Video Compression Standards Supported	H.265+/ H.265, H.264, H.264+, MPEG-4, M-JPEG, Dual stream encoding
Audio Compression Standards Supported	At least any one of G.711, G.726
Number of streams	Dual streams, both streams independently configurable for each camera resolution and frame rate
Recording Resolutions	HD (720p/1080p)/WD1/4CIF/2CIF/CIF/QCIF(can be set independently for each channel, for both streams)
Video Frame Recording Rate	1 to 15 fps for all channels at HD (total 60 fps) 1 to 25 fps for all channels at4CIF (total 100 fps) resolution and frame rate can be set independently for each camera, for both streams
Alarm Sensors	Minimum 8 inputs (NO/NC, configurable) 2 outputs
Storage	HDD with suitable anti-vibration mechanism & minimum 15 days of on-board storage. HDD to be pluggable and easily removable, secure and protected by lock mNVR should have storage capacity for at

Parameter	Minimum Technical Specifications
	least 15 days
Recording Modes	Normal, Schedule based, Alarm (via I/0 input e.g. Emergency Button, Video loss), Recording On –Green mark, 'Event' Recording –Red mark
Transmission and Remote Monitoring of 'Video surveillance' data	Transmit over 4G of ATD, log on Server and Remote monitoring (Server/Client & iOS, Android Mobile Terminal) along with GPS Location on map. (see example under GPS requirements) Transmission Settings: Always On, SMS/Telephone Snapshot at configurable frequency Alarm (via I/0 input e.g. Emergency Button, Emergency Door Open,) Snapshot Estimated data/ Camera WD1, Quality 1=65KB CIF, Quality 4= 9KB
Event Based Recording And Tagging	Pre-recording–1 minute Post-recording–1 to 30 minutes
Shut Down Delay	Configurable shutdown delay after ignition off up to 24 Hours
Power Input	9 to32 volts
Power output	Regulated power to CCTV cameras and Microphones and all other equipment used In the System
Working Temperature	-10 to 60-degree Celsius
Working Humidity	0% to 95% relative humidity
Network/ Communication	LAN – 1 RJ45 interface 4 ports PoE (IEEE802.3af/at)M12 connector Type A/B Wi-Fi – 802.11/b/g/n
Interfaces	Wi-Fi–802.11/b/g/n 2.4 GHZ Access Point - 10M for Data Download and System maintenance. Details as per Clause 5 Built-in3Gmodule, supporting both 2G and 3G/4G (at least900,1800and2100MHzfrequency bands), Support for SMS, Voice, Data, GPRS, TCP/IP-External Antenna Built –in GPS

Parameter	Minimum Technical Specifications
	Module-External Antenna
External Interfaces	1RS232, 1USB2.0, 1 Channel Pulse Speed Detection 1 SIM slot (Capable of using M2M Plastic, M2M Robust Plastic SIM and M2M Industrial SIM) –To be mounted in a Lockable Compartment
Image quality	1 to 8 (configurable) In case of following Quality will automatically upgrade to 1(configurable): Alarm (via I/0 input e.g. Emergency Button, Brake On, Reversing) triggered, Motion detection, Video loss, Camera Cover, Vehicle Speed, Threshold exceed on 6 axis Gyro
Watermark	Tamper-proof Watermark
Configurable Video Overwriting	Video over-writing to be configurable to support: Cyclic overwriting (oldest recording to be overwritten) Configurable days/Capacity/never Event tagged recording not to be overwritten for a longer period (7 to 30days, configurable)
Connections	All input and output connections to be vibration/shock Resistant and locking. Desirable: Aviation Connectors
Installation	360 deg mounting position
LED Indicators	Power, Recording, 3G/ GPRS Network, Recording Error, Alarm
IP Rating	Minimum IP53 with necessary ingress protection for anti vibration on In Bus Environment
Test Compliances	As Detailed later in this document
Health Parameters over 3G/4G SMS	Capable of sending health parameters (cameras not functioning, cameras tamper, HDD error, HDD full) at specified frequency to the server Capable of detecting failure, error or tamper of cameras or any component (Network Disconnected, IP Address Conflict, Illegal Login), Alarm (via

Parameter	Minimum Technical Specifications
	I/0 input e.g. Emergency Button, Emergency Door Open) triggered, Video loss, Camera Cover, No SD Card, No Recording, Vehicle Speed, Vehicle acceleration (SDS) ‘ Camera cover’- sensitivity is configurable –common to all Camera and sending alert to severe mail and SMS to preconfigured contacts.
Over-the-air Update/ Upgrade	Over-the-air update of configuration parameters of mNVR and cameras. Over-the-air upgrade of firmware The OTA updates will be based on Supplier Protocols
Video Detection	Motion Detection, Video Loss & Camera Blank
RTC	Built-in RTC with NTP synchronization provision, drift not more than 10 seconds at any time
Data Download and Configuration settings	mNVR should provide video and audio download facility for the desired date/time and duration. It should be possible to connect a laptop to mNVR through network cable on RJ45 port and open mNVR user interface in a standard browser using a standard URL such as http://nvr (or any other text specified by MoRTH) without having to configure the lap-top’s network settings. After entering user-id and password (specified by MoRTH), it will be possible to search, view, select and download video clips of desired duration and date/time in standard formats such as .avi or .mpg. It will not be possible to delete any video or change configuration settings using this set of user-id and password. Also, the data shall also be downloaded through remote login.
Data Transfer on 4G and 3G/2G	In case the vehicle moves to an area where 4G/3G coverage is not present, the mNVR will automatically shift to GPRS (2G) connectivity to send the health status data. Also, in such case, on press of an emergency button, the mNVR will automatically shift to a lower frame rate and resolution (both configurable) and send

Parameter	Minimum Technical Specifications
	the video from cameras to the backend server over GPRS .
Integrated Applications / Software to be Supplied along with Equipment and all Protocol will be proprietary	1. Playback of Record on Storage Media 2. Server/Client – 'Windows server 2012 R2 Standard' & iOS, Android Mobile Terminal 3. Export of Server Log 4. User and Evidence Management
ONVIF	ONVIF S & G Profile Compliant
Certification	BIS/UL, CE, FCC, EN50155, EN 61000, AIS004
Open platform	The system should be open platform and not proprietary solution, it should have integration with at least 50 leading IP camera brands of the world (List of IP camera to be attached)
Analytics	Camera tampering Trigger based recording form Panic Button
Panic button assistance	In the event of usage of panic button, mNVR shall share all in bus camera footages of total 60 seconds over 4G to control centre. (60 seconds = 30 seconds before the pressing of button and 30r seconds after the pressing of button)

ITS integration :

1) The Service provider shall maintain their own server from which the data shall be pushed to BMTC ITS application through Application Programming Interface (API). Further, all necessary software's required for integration shall be maintained by the service provider.
2) Real time GPS data, through Application Programming Interface (API) (Push) Protocol.
3) Panic/ SOS button when pressed, alert should go to BMTC ITS application and also 30 seconds video before and after panic/ SOS button press (Total 60 sec) should be sent to BMTC server through API (Push) by from the server of service provider.
4) Availability of live streaming of video through API (Push) to integrate with BMTC application.
5) Manual video download option to be available through API (Push).
6) 4G/ 5G SIM card for both ATD and mNVR to be provided by vendor along with data plan [ATD device (4G/5G)-500 MB minimum per month and for mNVR (4G)-2 GB minimum per month]

7) Appointing one nodal person from service provider to co-ordinate with BMTC security department and police department to share mNVR camera footage when sought for.
8) Integration shall be done within 45 days of commissioning of operational services. Fails to provide access to the data or fails to integrate with the BMTC ITS/AVLS shall attract Penalty of Rs.500 per bus per week.
9) If any partial data/no data/ delayed data / in accurate data is received from the devices, though the trip is operated completely, Penalty of Rs.500 per bus per week may be levied
10) Hardware Specification of ATD, mNVR & Camera's to be installed in bus is provided in the above table.
11) Service provider shall establish a command control Centre to monitor the operations and in turn shall share the monitoring report to BMTC on monthly basis, failing to which BMTC shall levy suitable penalty

Note:

I. The Bidder shall submit Technical Specification of Components/Systems of Electric Propulsion system and submit the test certificate for these components as per the prescribed standards from the notified testing agencies like CIRT, ARAI, VRDE, etc.
II. All electrical wiring harness and accessories used on electric bus shall comply necessary automotive safety standards.
III. All units & electrical accessories and wiring harnesses used in the bus shall be so mounted that they are easily accessible and can be removed without disturbing other components. Further these accessories and wiring harnesses shall be well protected to prevent ingress of water.
IV. Mandatory Certification Compliance and acceptance tests for Safety Components, Batteries, Buses and Requirements for Battery Charging Infrastructure Systems etc. by competent authority to be obtained.
V. Mandatory Certification Compliance for Safety Components, Batteries &Buses should be met
VI. The Bidder shall ensure the fitment of all electric propulsion system components on the bus confirming to National/International Standards.
VII. The Bidder shall undertake type approval testing of Traction Batteries pack fitted on the bus as per CMVR notified standard and submit copy of Approved certificate.
VIII. The Buses shall meet all the above technical specification requirements. The buses shall be deemed satisfactory for operation only after the buses meet all the requirements prescribed above.
IX. The Bidder shall monitor the operation of these Buses and sort out the operational issues, if any.
X. The Bidder shall ensure safe & successful operation of these buses. In

case of breakdown in these vehicle systems or battery charging infrastructure system, the Bidder shall immediately rectify the defects / replace parts and make the Buses, vehicle systems or charging system operational as the case may be.

XI. Manufacturers need to meet high safety standards for battery packs. These standards include a protection level that is no less than IP67—which represents a high water and dust proof battery pack—and satisfactory operation safety in extreme temperatures ranging as per manufacturer design or CMVR.

XII. Bidder to submit the type approval certificate, homologation certificate, for the allocated bus at the time of prototype bus inspection.